SP-20
Log M-278

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: July 2, 1985

Forwarded to:

Honorable George C. Wallace
Governor of Alabama
Montgomery, Alabama 36130

SAFETY RECOMMENDATION(S)

M-85-47

About 1130, on July 7, 1984, the uninspected excursion vessel M/V SCITANIC was down bound on the Tennessee River, near Huntsville, Alabama, when strong winds generated by severe thunderstorm activity caused the vessel to capsize. Of the 15 passengers and 3 crewmen aboard the vessel, the crew and 4 passengers were able to escape from the capsized vessel; 11 passengers were trapped inside the vessel and drowned. The damage to the SCITANIC was estimated to be about $65,000. 1/

When the SCITANIC got underway, there were no observable signs of inclement weather. The 1000 weather forecast obtained by the captain before he departed the vessel's berth had indicated that thunderstorms could be expected in the afternoon. There were no indications in the weather forecast up to the time the vessel got underway which would have alerted a mariner to the probability of severe thunderstorm activity in the area within the hour. However, the use of one of the two portable radios located in the pilothouse to monitor the latest National Oceanic and Atmospheric Administration (NOAA) weather forecasts would appear to be a reasonable precaution for a vessel carrying passengers in an area of frequent thunderstorm activity, and where thunderstorms can build up quickly. If the captain had been monitoring the weather broadcasts, he could have learned as early as 1050 that thunderstorms could be affecting the area during the next hour. At 1050, it would have been possible for the vessel to return to its berth before the storm broke.

By the time the captain and first mate recognized that the SCITANIC would encounter a thunderstorm, the vessel was about 1.3 miles from its berth at Ditto Landing and the closest refuge. To continue to proceed down the river toward the marina would have resulted in exposing the vessel's port side with its extensive sail area to the increasingly strong westerly winds generated by the approaching thunderstorms. The captain reacted by turning the vessel to head into the wind--a maneuver which had been used successfully on several past occasions when the vessel encountered passing thunderstorms. Turning the vessel into the wind probably would have been successful on the day of the accident except for the occurrence of four microbursts, one about 1/4 mile away, which produced a sudden wind shift with exceptionally strong winds.

1/ For more detailed information, read Marine Accident Report--"Capsizing of the Excursion Vessel M/V SCITANIC on the Tennessee River, near Huntsville, Alabama, July 7, 1984" (NTSB/MAR-85/05).

The microburst phenomenon first was identified as a cause for some types of wind shear in 1976. It involves a narrow downward moving column of air generally less than 2 1/2 miles (4 km) in diameter associated with the rain shower developed by a thunderstorm. The column of air is generated by the rapid evaporation of water droplets or rain within the thunderstorm. In some microbursts, known as dry microbursts, the shower evaporates before reaching the ground. The evaporative cooling causes the density of air to increase causes the column to accelerate downward. When a microburst reaches the ground, it spreads out beneath and beyond the thunderstorm cell, causing high and often damaging winds to flow radially from the thunderstorm cell. The horizontal surface winds radiating from a thunderstorm are a vector combination of the outflow of the microburst and the motion of the thunderstorm. Consequently, the strongest winds are usually in the direction of the thunderstorm movement. Microburst winds have been estimated in some instances to exceed 100 knots.

In recent years, considerable effort had been directed to predicting or detecting microbursts at airports since wind shears, often microbursts, have caused serious aircraft accidents. The capsizing of the SCITANIC, however, is the first marine accident investigated by the Safety Board where a microburst has been implicated as a causal factor. Damaging microbursts are believed to occur relatively infrequently compared to the number of thunderstorms that occur throughout the continental United States. However, due to the small size of the area affected and due to the relatively short duration of a microburst, most are not detected by weather stations, or brought to the attention of weather stations, unless significant damage occurs. Present technology does not offer a reliable method of predicting when a microburst may occur; however, there is a relationship between the probability of a microburst and the intensity of a thunderstorm. In some areas of the country, namely the desert southwest and the high plateau east of the Rocky Mountains, a probability of microburst development may be estimated based upon synoptic conditions; however, these conditions are of a different character than those found in the moist areas of the southeastern United States, including the Huntsville area, where little research into this phenomena has been conducted. Much of what is known about this phenomenon has resulted from weather research projects conducted at Chicago, Illinois, in 1978 and at Denver, Colorado, in 1982 and 1984.

During the summer of 1985, the Federal Aviation Administration plans to conduct a thunderstorm and microburst research experiment at Memphis, Tennessee. The experiment will analyze the structure of thunderstorms. Efforts will be made to correlate the data recorded by the extensive number of monitoring stations that will be installed for the experiment to identify conditions which may be conducive to the generation of microbursts.

During July and August 1986, the National Science Foundation (NSF), the National Aeronautics and Space Administration (NASA), and the National Oceanic and Atmospheric Administration (NOAA) will conduct a joint weather research program in the Huntsville, Alabama, area. The program, the Microburst and Severe Storm Project (MIST), will utilize at least 3 doppler radars, 8 upper air sounding stations, and 70 surface stations supplemented by aircraft measurements. The purpose of the program is to study the structure of severe thunderstorms, particularly in the moist environment of the southeastern United States, and to analyze the use of doppler radar in detecting microburst activity. Among the reasons for selecting Huntsville as an experimental site are the frequency of severe thunderstorms in this area.

The Safety Board has made 32 safety recommendations 2/ concerning wind shear, including wind shears generated by microbursts. The recommendations have addressed the need for doppler radars, as well as research into the structure of severe thunderstorms and the identification of those which may generate microbursts. The Safety Board actively monitors the response to its recommendations and the efforts of Federal agencies to counter the hazards caused by high wind disturbances. In this regard, the Safety Board supports such programs as the Microburst and Severe Storm Project (MIST) scheduled to be conducted in Huntsville in 1986. The results of this work should provide benefits to the public, including marine and aviation interests.

The SCITANIC's stability exceeded the U.S. Coast Guard (USCG) criterion found in 46 CFR 170.170; it had 11 feet of GM, and only 9.7 feet would have been required had it been a vessel of usual proportions. However, the SCITANIC was not a vessel of usual proportions, and if operated under Coast Guard standards, it probably would have been required by the USCG to meet additional criteria similar to that contained in CFR 170.173. Below is a comparison of the USCG requirements in 46 CFR 170.173 with the approximate righting characteristics of the SCITANIC on July 7, 1984, which indicates that the vessel did not meet all of the requirements.

		USCG Criteria 46 CFR 170.173(b)	USCG Criteria 46 CFR 170.173(c)
Minimum angle of maximum righting arm	10°	25°	15°
Area under righting arm curve up to maximum righting arm (foot-degrees)	8	-	-

Although the calculations show that the SCITANIC met the provisions of 46 CFR 170.170 as loaded on July 7, 1984, they also show that the overturning moment of the 70-knot wind experienced by the SCITANIC would exceed its righting moment and the vessel would capsize. Also, the calculations show that the vessel probably would not have capsized at wind velocities less than 65 knots. However, if the SCITANIC had met the USCG criteria in 46 170.173, it may not have capsized. The stability of the SCITANIC, while reasonably good, could have been increased substantially by installing an additional small pontoon on each side to increase the vessel's beam. Stability also could have been increased by adding ballast weight to lower the vessel's center of gravity. If the addition of the ballast required an increase in buoyancy, this could have been provided by enclosing some of the space between pontoons to form buoyant tanks. The SCITANIC could have been safer if there had been a procedure for insuring the adequacy of its stability before it was initially placed in service.

2/ A-76-31 through -44, A-76-76, A-78-3, A-83-13 through -26, and A-85-26 and -27.

Therefore, as a result of its investigation, the National Transportation Safety Board recommends that the State of Alabama:

> Amend the Alabama Water Safety Act and applicable regulations to require that recreational vessels not subject to Federal jurisdiction, having two or more decks for passengers above the vessel's waterline be required by State law or regulations to meet U.S. Coast Guard stability criteria in 46 CFR Subchapter S. (Class II, Priority Action) (M-85-47)

BURNETT, Chairman, GOLDMAN, Vice Chairman, and BURSLEY, Member, concurred in this recommendation.

By: Jim Burnett
Chairman